Incorporating "The Illuminating Engineer."

Light and Lighting

Official Journal of the Illuminating Engineering Society.

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Research

THIS is what many of us, starting in life, hope that we shall be called upon to do—to make some great discovery, invent some new process, of great benefit to mankind—surely the most solid and enduring title to fame.

But in these days it is given to few to achieve, as individuals, great discoveries. Advances tend more and more to be the result of patient team work, in which many take a share.

Last month members of the Illuminating Engineering Society were treated to a delightful and informative description of work of this kind. The address given by Mr. Warren, in the Lecture Theatre of the B.T.H. Research Laboratories, was packed with good things. At the end of his lecture Mr. Warren made generous acknowledgment of the services of his staff.

There are other centres of research in the lighting industry where similar good work is being done. Much of it naturally has a practical bent. Research must pay its way. But much has also a general bearing. All credit to those who do not hoard such knowledge but let it become known, to the general benefit.

The New Factory Act and Factory Lighting

This topic, which provided material for a lively discussion in London on January 19, has also been dealt with at a meeting of the I.E.S. local centre in Glasgow.

Mr. J. Galloway's opening address contained an informative survey of the evolution of the Factory Acts during the period of the industrial revolution from 1802 onwards. The "Health and Morals Act" in that year was concerned primarily with the condition of the young workers, for whom an age limit of nine years and a working period not exceeding twelve hours daily was prescribed. Measures introduced in 1819, 1831, and 1832 all had a similar object. Following the Royal Commission of 1833 the first real Factory Act was introduced. This reduced the working period of juveniles to nine hours daily and made daily attendance at school compulsory (the first time such attendance was enforced by Statute), and for the first time factory inspectors were appointed. The recognition by them of various industrial dangers led to further Acts in 1844, 1845, and 1847.

Only gradually did the Acts, originally applying only to textile mills, come to apply to factories generally. The Act of 1878 applying to "factories and workshops" was the groundwork of modern legislation.

Passing over subsequent Acts, now embodied in the "new Act" of 1937, Mr. Galloway pointed out that this required adequate and suitable lighting for the first time. He discussed the various clauses relating to illumination embodied in the Fourth Report of the Departmental Committee, and gave two instructive instances of the importance of a standard of illumination in passages, corridors, and corners. The first of these related to a man coming from a brightly lighted drawing office and passing along an unlighted corridor on his way to the works. He fell over an unseen broom left by the cleaner and dislocated his shoulder. The other concerned an apprentice, accustomed to hanging his coat in an ill-lit corner, who damaged his thumb on an unseen projection.

In conclusion, Mr. Galloway pointed out that the values prescribed, whilst apparently modest, were *minima*, and their enforcement would create a much higher average.

Mr. Galloway concluded his address by a series of lantern slides illustrating points in the Report, and a good discussion followed in which Mr. H. M. Fulton, Mr. Hunt (Deputy Superintendent Inspector of Factories for Scotland), Mr. M. W. Hime, Mr. E. J. Stewart, and Mr. H. E. de Weerdt and Mr. D. MacLeod took part.

Third Conference on Industrial Physics

The above conference is to be held this year in the Physics Department of the University of Leeds, and will take place from March 23 to March 25. The meetings are intended to be informal, and the proceedings will not be published. The subjects include "The Physics of Humidity" (Prof. R. Whiddington), "Industrial Humidity Control and Measurement" (Dr. Ezer Griffiths), "Colour and Colour Rendering" (Dr. C. C. Paterson), "The Contribution of Physics to the Development of Industrial Process Control" (Mr. D. Harrison), "Automatic Regulators for the Textile Industries" (Dr. M. C. Marsh), and "Heat Effects in Fibres and Other Systems" (Dr. C. G. Darwen). There will be an exhibition of books and apparatus relating to the subject matter of the conference. Visits to textile mills, etc., will be arranged. Membership of the conference is open to all interested, and there is no conference fee. Those interested should apply to the conference secretary (Mr. H. R. Lang, 1, Lowther-gardens, Exhibition-road, London, S.W.7) for further particulars.

I.E.S. Meetings

N.B. *Unless otherwise announced all meetings commence at 7 p.m.*

LONDON.

Mar. 17th. Two New Public Lighting Installations—Central Dublin City and Dublin Dalkey Main Traffic Route (F. X. Algar): *E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2.*

Mar. 28th. A Debate on Illuminated Signs (J. Langdon, C. Williams-Ellis and Humphrey Baker): *Tudor Room, Caxton Hall, Caxton Street, S.W.1.*

Apl. 4th. Visibility Meters (C. Dunbar): *E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2.*

Apl. 18th. The Application of Air-cooled High Brightness Mercury Vapour Lamps to Projection Problems (V. J. Francis and G. H. Wilson): *Institution of Mech. Engrs., Storey's Gate, S.W.1.*

MANCHESTER.

Mar. 15th. Discussion on **Lighting and Architecture** (Speakers: L. M. Tye and H. Elder): *Engineers' Club, Albert Square.* **(7.15 p.m.)**

LEEDS.

Mar. 13th. The Economics of Factory Lighting (W. F. Pogson): *The Electricity Showrooms, The Headrow.*

BIRMINGHAM.

Apl. 14th. Romance of Illuminating Engineering (F. S. Ette): *White Horse Hotel, Congreve Street.*

GLASGOW.

Mar. 15th. Annual General Meeting and Paper on Louvre Control. *19, Gordon Street.* **(7.30 p.m.)**

DUBLIN.

Mar. 21st. Airport Lighting. *Engineer's Hall, 35, Dawson Street.* **(6.30 p.m.)**

Cinema Auditorium Lighting

Mr. T. P. Bennett's address on Cinema Lighting to the I.E.S. Decorative Lighting Section on February 28 was warmly received. It covered a wide range and included a considerable amount of useful information, both in regard to decorative effect and such practical points as are involved in maintenance, etc. In the course of his address he recalled the series of values of illumination in different parts of a cinema proposed in America, ranging from 50 to 100 ft.c. under the marquee to five in the foyer, and 0.1 to 0.2 in the auditorium, whilst pictures are being shown. The latter figure is considerably higher than the 0.05 ft.c. specified in the recently issued I.E.S. report to the London County Council. It was pointed out in the discussion, however, that the position here is somewhat similar to that in connection with the Departmental Committee's report on Factory Lighting—the value suggested to the L.C.C. is definitely a minimum, and is fixed in accordance with the special terms of reference of the Committee. There is, of course, all the difference in the world between a value which may form the basis of restrictions or legal action and one which is simply a recommendation. There can really be no doubt that 0.1 to 0.2 ft.c. (or even higher values if the light was judiciously arranged) could be furnished in the cinema theatre without any detriment to the appearance of the picture and with considerable benefit to the comfort of the audience, but it is one thing to advise this step and quite another to compel it!

I.E.S. Annual Meeting

May 9th, 1939

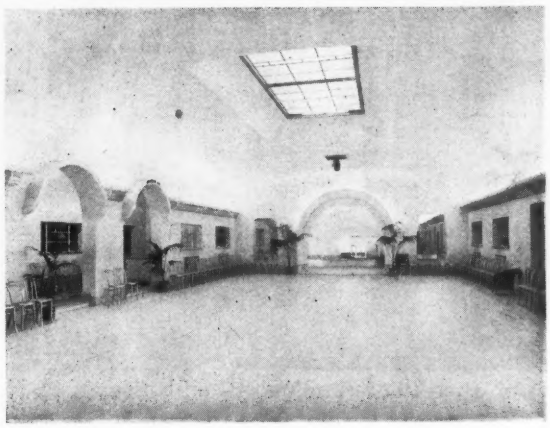
The **Annual Meeting** of the Illuminating Engineering Society will take place in the Lecture Theatre of the Institution of Mechanical Engineers (Storey's-gate, Westminster) at 7 p.m. on **Tuesday, May 9.**

After the annual report and accounts of the Society have been presented, and the usual formal business transacted, the presidential address will be delivered by Mr. Percy Good, who, we understand, will deal mainly with experiences during his recent visit to Australia and New Zealand.

"Who Goes Home?"—The Modern Linkman

A novel luminous device has been introduced by the management of a theatre in The Hague. Owing to the situation of the theatre in a very narrow street the dispatch of visitors in their cars after performances has always been a difficulty. When a car drew up much time was often wasted because those waiting for it were unaware of its arrival. According to the new method, when a car draws up before the performance the visitor and the chauffeur are each given a numbered ticket The cars are parked in an adjoining street and are brought up to the entrance after the performance in such order as the police may decide. As they do so each chauffeur produces his numbered check at a control point from which the number is electrically flashed on a notice board visible to theatre patrons waiting in the foyer. As there is room for five cars to draw up simultaneously five numbers appear in order on the board, and patrons are at once made aware when their car is approaching. On the first evening after the device was installed sixty-three cars were disposed of in 22 min., and on the second evening ninety-one cars in 24 min. After all concerned have had more experience of the system it is hoped that much better results will be recorded.

Colour Lighting in a Dance Hall



Colour lighting equipment is now quite a usual feature in modern entertainments. The above picture of Matheson's Dance Hall, Falkirk, shows how readily different methods can be combined. The main lighting in this case is by means of a four-colour equipment from the new Holophane trough system. Additional colour lighting is furnished from the ceiling laylight, which is equipped with special diffusing glass, and the colour from this laylight is kept in contrast with that from the cornices. The stage has a domed background which scintillates with coloured light projected from concealed sources, and the proscenium surround enables coloured lighting equipment to be concealed. Lighting control is effected by the Holophane auto-selector system. By manipulating the pointer on the dial of the selector any desired colour effects can be obtained. Both the colour lighting and the white lighting in the hall are controlled by the automatic dimming mechanism.

E.L.M.A. 40th Illumination Design Course

We have before us the programme of the above four-day course which is to take place at the E.L.M.A. Lighting Service Bureau (2, Savoy-hill, London) during April 17 to 20.

The first three days are devoted to a series of addresses (there are seventeen items in all) on such topics as Light Measurement, Illumination Design, Lighting and Eyesight, School and Factory Lighting, the Planning of Lighting Installations, Floodlighting, Light in Relation to Architecture, etc

On the Friday there is a special Continuation Course for lighting specialists of supply undertakings. Attention is here devoted to such matters as the Organisation and Delivery of Lectures on Lighting, Light Demonstrations, the Study of Sound Films for Lighting Promotion, etc.

This final section of the course is open to members of supply undertaking only, whereas the rest of the course is open to the electrical industry as a whole.

It should be unnecessary to recall that these courses have become more and more popular year by year. As accommodation is limited, those desiring to attend the course are advised to put in their applications as soon as possible.

The B.T.H. Research Laboratories, Rugby

Visited by members of the Illuminating Engineering Society on Tuesday, February 14th.

Members of the Illuminating Engineering Society spent a most entertaining day on February 14, when a visit was paid to the B.T.H. Research Laboratories at Rugby. There was a keen demand for tickets. It was impossible to find room for some of the latest applicants in the party, necessarily limited to 100 by the dimensions of the lecture theatre. Of those attending approximately 60 per cent. came from London and the remaining 40 per cent. from the various local centres in Birmingham, Leeds, and Manchester, so that an unusually good opportunity was afforded for members from different parts of the country to gather together.

Everything passed off smoothly and the arrangements made for entertaining visitors proved to be remarkably complete. Special saloon cars were provided on trains to and from London. On arrival at Rugby at 11.20 a fleet of "Midland Red" buses conveyed the party to the B.T.H. works and, later on, to the luncheon in the Masonic Hall.

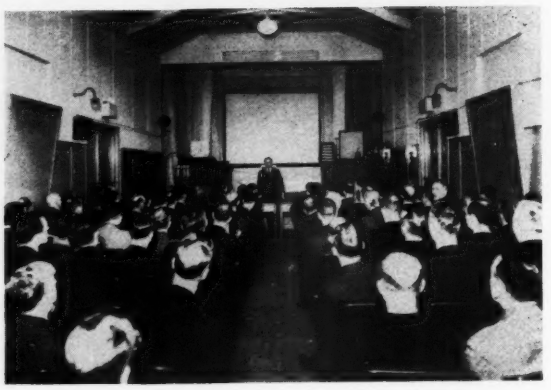
Inspection of Factories.

On arrival the party assembled in the new office building, where they were greeted by Mr. H. A. Lingard, one of the directors. This imposing new building, which contains the additional accommodation for the new research laboratories, was erected only in 1938 (the original date proposed for the visit had actually to be deferred so that everything might be ready), so that the Society was favoured by being among the very first to inspect these new developments.

During the period before luncheon it was naturally only possible to see a small part of these immense works—covering about 94 acres and evolving products ranging from miniature lamp bulbs to huge turbo-generators.

Attention was naturally concentrated mainly on the lamp works, where the marvellous ingenuity of the machinery was much admired. Many special types were noticed. In one of the factories is located a special lamp development laboratory (under the control of the research dept.) where new lamps can be made in substantial quantities such as enable their possibilities to be thoroughly tested before they become a regular factory production. In the laboratories there were on view experimental lamps varying in size from 15 watts to several kilowatts; mercury, mercury-cadmium, sodium, neon, and luminescent discharge lamps; special purpose lamps for colliery work, signalling, projection, ultra-violet, and stroboscopic work. The company is also concerned with the design of fittings, street lanterns, floodlighting equipment, etc., and in the numerous experimentally lighted roads within the area of the works it has excellent opportunities of testing road lighting equipment under service conditions.

Following the inspection of the factories the party was conveyed to the Masonic Hall for luncheon, when



A photograph of Mr. Warren delivering his lecture; taken by the light of the special "photographic" 400-w. mercury discharge lamp, momentarily overrun.

a short address of welcome was delivered by Mr. Sporborg, one of the directors. Mr. Percy Good (I.E.S. president) expressed the Society's appreciation of the hospitality of the British Thomson-Houston Company, Ltd., and their great interest in the things they had already seen.

Mr. Warren's Lecture.

The party were then taken back to the research laboratories (on their way getting a glimpse of the famous Rugby School buildings), where Mr. Warren's lecture on "Research on the Production and Utilisation of Light" was delivered. The lecture was illustrated by many demonstrations, all excellently staged, many interesting new developments being shown publicly for the first time.

In the early stages of his address Mr. Warren touched on problems involved in light production and illustrated the characteristic differences between the spectra of incandescent filaments and luminescent gases. He next showed by a diagram the inter-relation between the various lamp development departments, the processes of photometry and lamp testing, and the factories. Pictures of the photometric laboratories were shown, and reference was made to such special apparatus as the refrigerator and oven in which the behaviour of lamps under wide extremes of temperature can be studied, and the 6-ft. integrating sphere built at Rugby. The facilities for life-testing of lamps—in practice as well as on racks in the laboratories—were explained. It was mentioned, for instance, that a life-test of high-voltage fluorescent tubing was actually taking place in the entrance to the lecture theatre, where some striking decorative lighting effects had been installed. Another form of special test for lamps, the "Ogpu"

Members inspecting the large integrating sphere in one of the Photometry Laboratories.

machine, consists of a platform supported on springs, on which is mounted a variable speed motor with an out-of-balance flywheel. The results of such vibrations on the lamp supports can be studied by means of a special stroboscopic lamp, previously described before the Society.

After referring briefly to such recent novelties as the 80-watt and 125-watt discharge lamps with quartz arc tubes, and the still greater concentration of brightness in lamps intended for cinema work, signalling, and other special purposes, Mr. Warren passed on to a very highly interesting field of work —the application of discharge lamps for coloured film projection. In spite of the variation in radiation between the carbon arc and the air-cooled or water-cooled mercury discharge lamps, the latter can be applied with considerable success to films produced by the three-colour process, as Mr. Warren, by means of several most effective displays of films, showed.

A New Miners' Lamp.

Another quite new development, next described, excited great interest. This was a form of discharge lamp for use in mines—a 40-watt, high-pressure mercury vapour lamp with a quartz arc tube, to which current is supplied by a turbo-generator driven by compressed air. The combination forms a unit which can be used in mines with safety, and operates at 35 lumens per watt, thus furnishing a far brighter light than any ordinary miners' lamp can yield (so much so that when it has been in use colliers have been known to do an amazing thing—walk away from the coal face forgetting to take their hand-lamps!).

Yet another novelty was a 400-watt mercury discharge lamp, with a circuit so arranged that it is momentarily given a high overload, with a corresponding flash by which photographs can readily be taken. (The picture appearing at the head of this article was taken by this means.)

Mr. Warren concluded this section of his address by mentioning some recent researches having for their object the improvement of sodium lamps, and also exhibiting a number of specimens showing the range of colour obtainable in tubes coated with fluorescent substances.

The second part of the address covered a wide range of applications of light. Some mention was made of the recent work undertaken in connection with the study of street lighting and road brightness, and of the newly designed telebrightness meter, recently exhibited to the Society.

Discharge lamps have been found to be capable of radio interference, more particularly those of the high-voltage type. Such disturbing effects can, however, be eliminated by short-circuiting the high frequency components of the disturbing voltage through small condensers connected between the line conductors and the earth conductor.

Improvements in Cinema Projection.

Mr. Warren turned next to some work recently done in the laboratories in connection with cinema projection. He described first a form of shutter giving a gradual cut-off such that flicker is appreciably reduced and the total light reaching the screen is increased by 40 per cent.

Substantial improvements have also been made in the efficiency of projection of light on the screen. With present-day films about 11 ft.c. is required on the screen, which may be up to 32 ft. in width. Thus a total light output of 7,000-10,000 lumens is necessary. By methods hitherto employed only a small fraction of the light emitted by the source reaches the screen. With the traditional method of focusing the

Examining the new miners' lamp described in Mr. Warren's lecture.

image of the crater of the arc on to the gate by means of a large condenser lens the efficiency was low—of the order of 0.2 lumens per watt. The more recent mirror arc lantern, with its increased light collection angle, attains an efficiency of the order of 0.5 lumens per watt. A still more recent type of lantern operates at 0.8 lumens per watt, whilst with the extra high-pressure quartz envelope mercury lamps an overall efficiency of 1 lumen per watt is possible. Projection of black-and-white films with such a source is quite satisfactory, the blacks appearing somewhat denser than with normal arcs. With colour correction the source can also be used for certain forms of coloured films, though Mr. Warren issued a warning against precipitate action in this respect.

A Coloured Surround to Films.

The next development illustrated was the use of a coloured surround whilst films are being shown. A black surround is unnatural and tends to make colours of films appear unnaturally bright, whilst greys in black-and-white films are adversely affected. (Mr. Warren showed by several demonstrations how greatly one's impression of such a shade is affected by its background or surround.) According to the method now evolved the colour and intensity of the surround vary with the picture. The colour is the average of the colour in the picture and the intensity is proportional to the screen brightness. The control is automatic and the system is an optical one. Demonstrations showed the improved appearance of the picture with a surround of this kind, coupled with a diminution in eye-strain and the production of a slight stereoscopic effect. The same principle has also been applied to the control of the auditorium lighting from the film projector, which was also illustrated by experiments; the idea can be extended to the control of three or more colours by the use of selective filters between the screen and photo-sensitive relays.

In winding up his address Mr. Warren made brief reference to other interesting problems on which the laboratory is engaged, such as those associated with studio illumination and large screen television projection, including control of the light-output characteristics of the fluorescent screens.

Thanks to the Staff.

Finally, Mr. Warren asked all those present who were in any way associated with the work of the Research Laboratories to stand up, and paid a generous tribute to the value of their assistance.

The President of the Illuminating Engineering Society moved a vote of thanks to Mr. Warren for

his very informative lecture, which was carried with acclamation, and some of those present took the opportunity to ask a few questions about the exhibits. Mr. Warren, Mr. L. J. Davies, and others having replied to these, a tour of the Research Laboratories, followed by tea, completed the visit.

The Research Laboratories.

Here again it was only possible in the time available to get a brief glimpse of the many varieties of work going on, but inspection was very greatly facilitated by the extensive glass window of each side of the corridors through which visitors passed. Many of the corridors were lighted by special methods—the main corridor, by a series of fluorescent discharge tubes, yields light of different colours.

The research department occupies some 60,000 sq. ft. and employs a staff of about 250. Whilst experiments in progress on electric lamps and apparatus in the photometric laboratories received most attention, there were many other aspects of the work of great interest in connection with illumination—notably that bearing on films, which seems to have developed to a remarkable extent. The very ingenious and effective film illustrating problems in connection with road lighting recently produced in the laboratory may be recalled. The laboratory is, however, constantly engaged on technical films, as well as original work on cinema projectors and film apparatus of the kind described in the lecture.

Reviews of Books

Light in Daily Life. J. Stewart Dow. (The Technical Press, Ltd., London. 127 pp. Price, 3s. 6d.)

Readers of "Light and Lighting" will remember the series of articles which appeared anonymously in 1936-37 under the heading which forms the title of this book, and they will be the first to welcome the reappearance of this popular exposition of their subject in a handy and most attractive form which does great credit to author and publishers alike. As Mr. Dow points out in his preface, there are now quite a number of books dealing with the more technical aspects of lighting; he has therefore addressed himself primarily to the user of light in the office, the home, the factory, and the street.

For the benefit of those who cannot conveniently turn up their past files of the Journal it may be mentioned that the early chapters deal respectively with the rise of the lighting art from prehistoric to present times, the relation of lighting to seeing, the lighting of roads, and the use of light for facilitating all forms of transport by land, sea, or air. Two other chapters are devoted respectively to light in the factory and in the home, while "Light the Salesman" is the heading of a short chapter on shop lighting. The lighting of theatres and other places of entertainment, both indoor and outdoor, is dealt with in a chapter which will interest many non-technical (as well as technical) readers, while the same is true, perhaps to an even greater extent, of the concluding chapters entitled "The Marvels of Invisible Light" and "Light in Time to Come."

The style in which the book is written is popular and stimulating, and it should succeed in holding the interest of the most non-technical reader; at the same time, it is refreshingly free from those inaccuracies or half-truths which mar so many well-meant attempts to interest the general reader in subjects which have become technically somewhat highly developed. The author should therefore be able to add the congratulations of every member of his wide circle of technical readers to the gratitude of an even wider public whom he has made his debtors by giving them such an entertaining insight into the many and varied applications of "light in daily life."

Considering the nature of the book, it would, perhaps, be unreasonable to ask for an index; but the very full table of "Contents" would have been enhanced in value if the number of the first page of each chapter had been given. Apart from this quite minor omission, the way in which the book is produced calls for high commendation, especially in view of the remarkably low price. This, incidentally, should materially assist the author to achieve his aim, viz., to put a sound popularisation of the subject into the hands of as large a section as possible of the community which, for the most part, combines appreciation of the illuminating engineer's work with only the vaguest idea of "how it is done."

Also Received:—

Public Library Lighting. By R. D. Hilton Smith, F.L.A. Vol. II. Artificial Lighting, Part I.; General Principle of Planning. (Alex. J. Philip, Gravesend, 1938. 95 pp. price, 7s.)

NATIONAL ILLUMINATION COMMITTEE OF GT. BRITAIN

Annual Report for the Year 1938

(Presented at the Annual Meeting of the Committee held on Wednesday, February 15th, 1939.)

Work of the National Committee.

The Committee is pleased to be able to report that the number of changes in its personnel during the past year has been small. Captain Cresswell, who recently retired from the Post Office, has been succeeded by Mr. H. W. Fulcher, while Mr. J. G. Clark, who has for some years represented the British Commercial Gas Association, has, also because of retirement, been replaced by Mr. Dean Chandler.

Diploma in Illuminating Engineering.

Classes have now been commenced by five educational bodies in connection with the Certificate in Illuminating Engineering offered by the City and Guilds of London Institute. It will be remembered that the National Committee was initially responsible for arranging the conference from which this Certificate originated. Professor J. T. MacGregor-Morris, who has been appointed Emeritus Professor of Electrical Engineering in the University of London, is acting as examiner.

Home Office Factory Lighting Committee.

Early in the year the Committee was invited to prepare and present evidence to the Departmental Committee on Factory Lighting set up by the Home Office. The evidence was prepared by two sub-committees, namely, those on Factory and Office Lighting and on Daylight. Oral evidence was also given before the Departmental Committee by Mr. Beuttell, Dr. Buckley, Mr. Clark, Dr. Crowden, Mr. Long, Mr. Murray, and Mr. Ritchie. The report of the Departmental Committee has since been published. It is satisfactory to record that in many respects its recommendations agree with those made by the National Committee.

Housing Commission of the League of Nations.

A meeting of the Housing Commission of the Health Organisation of the League of Nations was held in Geneva in June, and the meetings were attended by Dr. Buckley on behalf of the British

National Committee. Matters dealt with included insolation, as well as natural and artificial lighting, in relation to housing and town planning. A report dealing with these aspects was prepared and has since been published.

Work of the Sub-Committees.

In the year under review there has been considerable activity among the sub-committees in preparation for the meetings of the International Commission on Illumination, to be held at the Hague in June, 1939. Most of the sub-committees have been engaged either in the preparation of secretariat reports, in supplying information or in answering questionnaires received from other National Committees. The British National Committee is acting in a secretariat capacity for four subjects and in connection with these the principal activities have been as follows:—

Glare.

The sub-committee had discussed the proposed extension of its terms of reference to cover the wider subject of light and vision and has agreed that such an extension is sound. The Secretariat Report for the meeting in Holland has been prepared and summarises the results of some sixty papers on glare which have appeared in the period 1935—1938.

Classification of Light Distributions.

The Secretariat Report deals with the specification of light distributions as recently revised by the British Standards Institution on the basis of the "dispersive angle." Criticism has been invited from other National Committees ,and in response France, Holland, and the United States have sent in comments which are, however, not very favourable to the British proposals.

Alternative proposals have been made by the French Committee.

Lighting of Public Ways.

Replies to the British questionnaire on this subject have been received from France, Germany, Holland, and the United States and the Secretariat Report embodying these replies has been prepared. The sub-committee has also been engaged upon a street lighting specification to implement the recent report of the Committee on Street Lighting set up by the Ministry of Transport. A paper on this subject has been prepared by Dr. Paterson for the meeting in Holland.

Theatre Stage Lighting.

As the time available since the introduction of this subject at Paris in June, 1937, has not enabled full international co-operation to be secured, it has been decided to limit the Secretariat Report to a review of the present position of stage lighting in Great Britain. Other National Committees have been invited to submit separate contributions for discussion at the meeting in Holland.

The following is a summary of the principal activities of the remaining sub-committees, of which the secretariat is held by other countries:—

Visual Photometry.

A progress report on this subject has been forwarded to the Hungarian Committee. Experimental work in connection with the standard visibility curve of the human eye has been continued. This has provided further confirmation of the substantial validity of the values agreed upon at the Geneva meeting in 1924.

Architectural Lighting.

A draft Secretariat Report has been received from Italy, and the comments of our sub-committee, together with a number of photographs, have been dispatched to the Italian National Committee.

Daylight.

A questionnaire, dealing with both natural and artificial daylight, has been received from Germany; the two parts have been considered separately by our two sub-committees, and replies have been sent. The sub-committee dealing with artificial daylight has almost completed a specification for colour-matching artificial daylight lamps, which, it is hoped, will be available for consideration at the meeting in Holland.

Mine Lighting.

In addition to answering a questionnaire from the German National Committee, arrangements have been made for the presentation of a paper on "Nystagmus," by Dr. J. Wellwood Ferguson, at the meeting in Holland.

Applied Lighting.

This subject is divided into three parts:—

(a) Factory and Office Lighting.—A report dealing with the new Factory Act and the findings of the Departmental Committee has been sent to the United States National Committee, which is acting as Secretariat for all three sections. The sub-committee was also responsible for the preparation of the major portion of the evidence presented to the Departmental Committee on behalf of the National Committee.

(b) School Lighting.—The work on this subject has been undertaken by the Illuminating Engineering Society on behalf of the National Committee, and a report on the present position in Great Britain has been sent to the United States.

(c) Railway Lighting.—A report on the present position in Great Britain has been sent to the United States.

Other Sub-Committees.

In each of the following subjects a questionnaire has been received from the Secretariat country, and a reply has been formulated and sent: Physical Photometry, Colorimetry, Light Sources, Diffusing Materials, Automobile Headlights, Aviation (Ground) Lighting, Aircraft Lighting, and Lighting Education.

In the case of the two subjects, Ultra-Violet Light and Cinema Screen Lighting, it has not been found possible to undertake any work of an international character.

General.

In connection with the meeting of the International Commission on Illumination in Holland in June next, it is hoped that a large representative British delegation will attend so that the British point of view may be adequately presented.

The Committee again wishes to place on record its indebtedness to the Illuminating Engineering Society, the Institution of Electrical Engineers, and the Institution of Gas Engineers for their continued interest and their financial support, by means of which the Committee is enabled to continue its participation in the work of the International Commission. The British Standards Institution and the National Physical Laboratory have also rendered valuable services to the British National Committee by their generous co-operation.

K. EDGCUMBE,
Chairman.

The Dufay-Chromex Laboratories (Elstree)

Visit of the I.E.S. Photometry Section on January 31, 1939

About seventy members of the Photometry Section assembled at the Elstree Laboratories of Dufay-Chromex, Ltd., on the evening of January 31, 1939.

After light refreshments had been served, the party adjourned to the lecture room where Mr. C. H. Beale gave a very interesting talk. He said that there was so much to pack into the evening that he proposed to talk first and then, after the party had visited the laboratories and process station and had viewed a short length of film, they would reassemble in the hall for question time.

As time was limited Mr. Beale said that he could not discuss the whole question of colour photography but would touch only on certain points. The members of his company, he said, had a great regard for Dufaycolour, not only because of the results it gave but because the process itself was so beautiful—beautiful in the same way as the movement of a watch is beautiful on account of its fineness and delicacy.

He assumed that everyone was familiar with the trichromatic theory of colour vision: he would, therefore, deal straight away with the principles underlying the process of Dufaycolour photography, the problems they had encountered, and how they dealt with them. All colour photography depended upon the fact that the colours of nature, with very few exceptions, could be reproduced with good accuracy by means of three primary colours: two-colour and four-colour systems had been used but not with great success.

Mr. Beale then described additive colour photography—that is the method of mixing two or more colour lights to produce some other hue. The resulting hues obtained in this way, of course, were very different from those obtained by mixing the colours of a paint box. By projecting three beams of primary colours on to the screen and mixing them, Mr. Beale was able to produce white and a number of intermediate colours: then by easy stages the same effect was obtained by projecting a slide covered with tiny lines transmitting the primary colours which, by reason of their smallness, were confused in the eye to produce a sensation of white light.

The subtractive method of colour mixture Mr. Beale demonstrated by using thin transparent coloured discs which, when superimposed, transmitted only their common colour, and he followed this up by building up a coloured picture by placing suitably coloured positives one upon another.

All colour photography depended on one of these two methods for its results: Dufaycolour depended upon the additive method.

Mr. Beale went on to show, by means of lantern slides, how the Dufaycolour reseau was made up of tiny elements of the three specially chosen primaries in the red, green, and blue, the mounting structure of the reseau being shown in comparison with the human hair. Since the process started seven years ago they had been continually improving the luminosity and the colour of the primaries to give more exact reproduction of the original hues.

Mr. Beale then went on to describe the various manufacturing processes and by means of lantern slides illustrated how one thousand length of unsensitised film became imprinted with the reseau network by means of repeated dyeings and bleachings. Those parts of the reseau which were to be retained during any bleaching process were previously covered by a greasy ink printing from a line one thousandth of an inch wide. It was the fineness of this printing—finer, indeed, than banknote work—which was one of the beautiful features of the process. After the reseau had been completely printed it was very carefully examined at many points along its length by a form of colorimeter of their own design. It was necessary to keep a very sharp check on the width of the lines as these necessarily had an important effect upon the colour of the transmitted light with consequent distortion of the final photograph. The permissible variation in these measurements was only 5 per cent.

Mr. Beale emphasised the great difficulty they had in keeping out dust, and his slides showed the elaborate precautions they had to take in order to avoid dust spots.

Another problem, he said, which would be of considerable interest to members was that which arose in the duplicating of standard film for cine-circuit purposes. If the two films were placed directly in contact and illuminated by a source of no fixed dimensions it was possible for the reseau to produce queer moiré effects. By means of demonstrations he was able to show how this difficulty had been overcome by separating the two layers of emulsion by a suitable distance and arranging the size of the source in relation to its distance, so that the image of any one element of the reseau in the original fell on at least two elements of the same colour in the copy.

In making these reproductions the colour of the light source was of particular importance, and in order to avoid degradation of the colours it was necessary to have a source whose light emission was in the form of narrow spectral bands situated in such a way with respect to the transmission curves of the three primaries involved that each line was transmitted only by one of the primaries.

Light from a mercury vapour lamp, which also contained cadmium and passed through a didymium glass filter, gave them exactly the form of light source for which they were looking.

Mr. J. M. Waldram, the chairman, thanked Mr. Beale for his very interesting talk, and the vote of thanks was carried with acclamation.

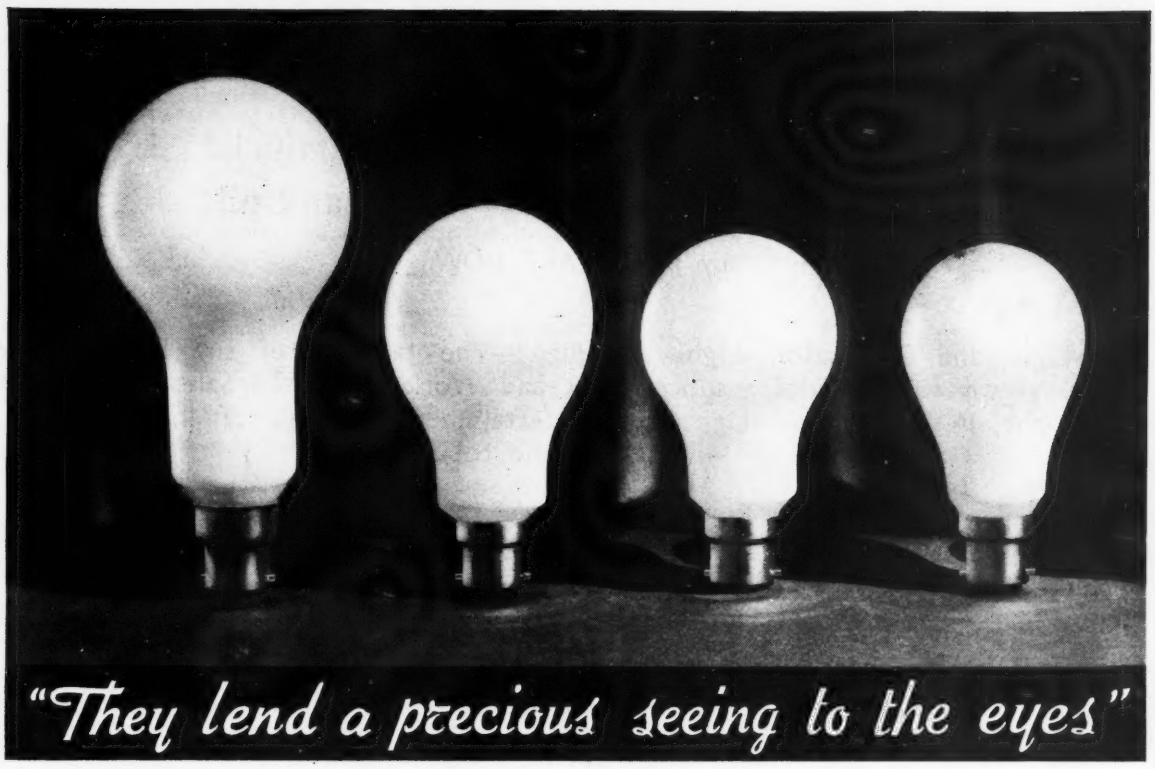
The party then separated into about five sections and made a tour of the laboratories and processing station. As had already been explained by Mr. Beale, the members found the laboratories divided into a number of small rooms, as was necessary in this type of work. Apparatus for the measuring of characteristic curves of the sensitive material was shown, together with an explanation of their routine testing. Members also had an opportunity of examining the particular type of colorimeter, which had been specially developed at these laboratories for the type of work on which they were engaged. It differed considerably from the usual form of trichromatic colorimeter, but was much simpler to use than the latter. In another laboratory the making of appropriate colour filters for use with the films was demonstrated.

(During the course of their tour of the laboratories some members were intrigued by a package labelled "Angels' Secrets," about the contents of which no adequate information could be obtained despite vigorous questioning of the staff!)

In the processing station members were much impressed by the almost complete mechanisation of the process. By a very ingenious system the spools of "amateur" films were lowered into the respective solutions, where they remained for a definite time, being mechanically transferred to the next solution at the end of that time: they were automatically conveyed from the dark room through a light trap to pass through the final stages before being carried out for drying in the warmed-air ovens.

The processes through which the cine-film is passed were also shown.

(*Concluded on page* 58.)



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The guides had some difficulty throughout in keeping the parties moving and replying to the innumerable questions with which they were bombarded.

During the tour the parties visited in turn the projection theatre, where a length of the film "St. Moritz" and some other demonstration lengths were run through the projector. Members were agreeably surprised at the quality of the results, although there were a number of minor criticisms one could have put forward in certain cases.

Owing to the time taken in the tour of the laboratories and the film demonstration, there was no time for the party to reassemble for questions, but all members left with the feeling of having thoroughly enjoyed the visit throughout and a sense of gratitude to Dufay-Chromex, Ltd., for their hospitality.

Sunlit Rooms for Schools

Some little time ago, when the Derwent Council School at York was being opened by Mr. Kenneth Lindsay, Parliamentary Secretary to the Board of Education, attention was drawn to the novel design of the building, indicating a distinct break from traditional design. The school is planned on open-air principles, with a maximum of light and ventilation, the hall and classrooms being built on the rim of a semicircle so as to receive the full benefit of the sun throughout the day. Each classroom has a completely glazed surface on two sides. The design of school buildings in order to secure maximum admission of daylight is an established principle. In modern buildings the daylight factor is remarkably high. It has, however, usually been assumed that direct *sunlight* during working hours is a drawback. Apparently authorities are now more favourably disposed towards admission of the sun's rays as well as diffused daylight.

Light in Relation to Production

It was unfortunate that the date of Mr. T. E. Catten's recent address on the above topic to the I.E.S. Industrial Lighting Section coincided with really appalling weather—readers will remember that day of snow and slush. This, besides the fact of the date (December 19) being somewhat near to Christmas, accounted for the unduly small attendance. We hope that another opportunity for the reading of the paper may be contrived, when due justice to it can be done.

Mr. Catten pointed out how the two primary elements in industrial performance, efficiency of staff and efficiency of plant, alike depend on good lighting, which affects in turn output (quality and quantity), spoilage, and lost time, accidents, and supervision. He quoted data presented in the D.S.I.R. reports to show the effect of illumination on output, in such processes as typesetting by hand and in silk and jute mills. He stressed the necessity for good illumination in processes involving measurements to 1-10,000th of an inch, and at the same time drew attention to the evidence of better work with improved illumination, even in such rough work as tile pressing.

Turning next to accidents, Mr. Catten discussed special types of accidents evidently influenced by lighting conditions, such as those due to persons falling. In this case there is evidence of a direct relation between lighting conditions and number of accidents. But lighting is a doubtless contributory cause in the case of a fair proportion of the immense number of accidents reported annually—upwards of 200,000 for factories and over 400,000 when docks, mines, quarries, railways, etc., are also considered.

Equally important is the indirect effect of accidents and mishaps in disorganising routine, slowing down effort and causing delay involving breach of contract.

Finally, there are the intangible but important "psychological effects"—the creation of mental inertia or dissatisfaction where there is gloom and shadow, in contrast with the feeling of confidence and cheerfulness found in rooms that are well lighted.

Electric Street Lighting

Barrow-in-Furness.—It has been decided to erect fourteen street lamps on the Links Estate, Walney, the cost of necessary mains and lamp standards being approximately £359.

Nuneaton.—Lutterworth-road, east of the White Stone, is to be lighted by twenty-one 65-watt sodium lamps at an average spacing of 150 feet. The capital cost of the scheme is estimated at £424 1s., and the annual running cost £7 17s. 6d.

Aberdeen.—Great Southern-street is to be lighted by 250-watt mercury discharge lamps. Electric street lighting is also to be installed on the Tullos and Anderson Drive South housing schemes.

Southport.—A new system of electric street lighting has been installed along the new Formby by-pass, between Woodvale Railway Bridge and the borough boundary. The whole installation is designed in accordance with the recommendations of the M.O.T. Final Report, and consists of eight 150-watt sodium discharge lamps at a mounting height of 25 feet, and an approximate spacing of 105 feet, staggered.

Crumpsall.—The Manchester Highways Committee have approved plans for the installation of eighteen 200-watt lamps in Delaunays-road, from Birch-road to Crumpsall-vale.

Tralee.—Tralee Urban Council, owners of the local gas works, have accepted the tender of the Electricity Supply Board for the public lighting of the town with 167 lamps at £722 per annum.

Hammersmith.—Lighting with mercury discharge lamps is proceeding. A new scheme, based on the recommendations of the M.O.T. Final Report, will cover eight to ten miles of road, so that when complete there will be a continuous stretch of mercury discharge lighting to Putney Bridge, past Hammersmith Broadway, and beyond Westway, as far as the Harrow-road. Street refugees on the Shepherds Bush-road are being provided with 125-watt mercury discharge lamps in opal bowls at a mounting height of 16 feet, in accordance with the M.O.T. recommendations.

Halifax.—An additional thirty-one mercury discharge lamps have appeared on important Halifax streets during the past twelve months, and 160 100-watt, thirty-two 150-watt, and fifteen 200-watt lamps have been installed in various other parts of the town.

Bedford.—Centralised control for Bedford's street lighting, which comprises some 2,000 electric street lamps, has been approved. The estimated cost of carrying out the work is £4,675, loan sanction for which is being sought. The trunk road lighting throughout Bedford is to be improved by the Highways Committee at a cost of £3,811, while other lighting improvements are to be carried out at a cost of £1,356.

Epsom.—It has been decided to light the main road from North Cheam to Leatherhead boundary by sodium discharge lamps at a cost of £6,200. The scheme will include a section of the Ewell by-pass road which is at present unlighted.

Oxford.—During the past twelve months the Oxford Electricity Department has installed 254 new electric street lamps, representing an additional load of 35.85 kw. The Department is now responsible for 1,457 street lamps with a total load of 381.6 kw.

Portsmouth.—During 1938 201 filament lamps and forty-three discharge lamps were installed. There are now 4,863 filament lamps and 815 discharge lamps in Portsmouth in sizes ranging from eighty to 1,000 watts.

Belfast.—On nine Belfast roads 372 electric lamps have been erected over a distance of approximately 13,000 yards. The cost of removing the 643 gas lanterns and columns amounted to £709 5s. 6d.

Croydon.—The Council has recently approved a scheme for the improvement of street lighting in the Edridge-road area, which also covers Friends-road, Mint-walk, Fell-road, and Mason's-avenue. The area is to be lighted completely by electricity at a cost of £6,396. Three additional 1,000-watt lamps are to be erected in Park-lane, while in Green-lane fifty-eight 100-watt sodium lamps are to replace thirty-four filament lamps. Bingham-road, Addiscombe, is to have thirty-three sodium lamps.

Shipley.—Discharge lamps along the full length of the Bradford-road, from Bradford boundary to Bingley boundary have been erected and placed in commission. The capital cost of the scheme amounted to £2,230, and will cost £1,234 per annum to maintain.

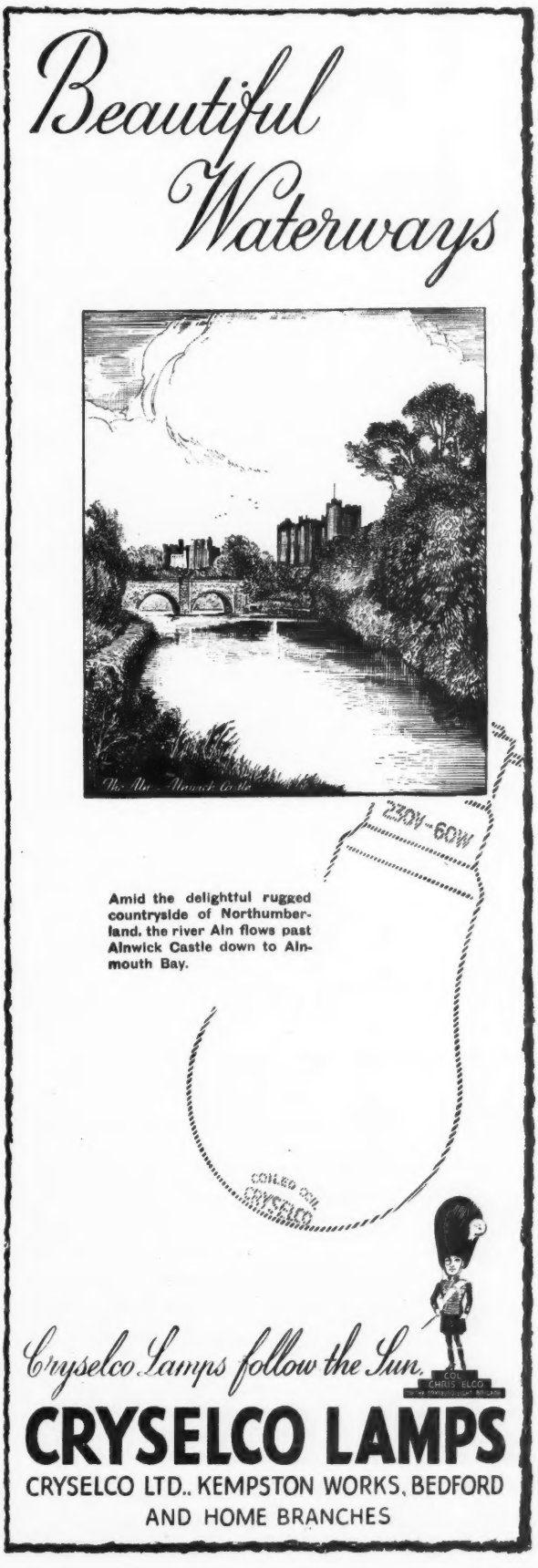
East Ham.—The Council proposes to improve the lighting of Romford-road by installing mercury discharge lamps at a cost of £1,470.

St. Marylebone.—Provisional street lighting estimates for 1939-40 amount to £5,000. Expenditure will be largely devoted to adjusting the standard of lighting in various thoroughfares according to traffic and other conditions.

Uckfield.—A recommendation by the Parish Council for the provision of 114 electric street lamps at a cost of £437.

Corby, Northants.—An improved lighting scheme involving the provision of thirty-one 250-watt mercury discharge lamps from the Jamb to Studfall-avenue has been accepted.

Gt. Baddow, Chelmsford.—An experimental electric street lighting scheme erected in Baddow-road is to be retained as the result of a decision by the Urban District Council.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Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

(Continued from page 35, February, 1939.)

I.—GENERAL RADIATION AND PHYSICS.

56. Infra-Red Light Finds New Heat Uses. Notes on Using Infra-Red Heat.
G. M. Allen. El. World, 110, p. 1,838, December 31, 1938.
Anon. El. World, 111, p. 148, January 14, 1939.
A brief summary is given of several different applications that have been made of the use of infra-red radiation for purposes of heating or drying. Large banks of lamps are generally used, and special lamps and reflectors are now available. Notes on the factors to be considered are added, with a reference to suitable reflective materials. S. S. B.

57. Characteristics of Phosphors for Cathode-Ray Tubes.
L. B. Headrick. Electronics, II., No. 12, p. 31, December, 1938.
Several data, in the form of curves and a table, are given on the most important characteristics of phosphors used in cathode ray tubes for oscillography and television. These include spectral distribution of emitted radiation and persistence time for the different materials considered. S. S. B.

II.—PHOTOMETRY.

58. Initial Drift in Photocells.
E. D. Wilson. Electronics, 12, No. 1, p. 15, January, 1939.
When a voltaic photo-electric cell is exposed to light there is a gradual change in the sensitivity of the cell in the initial period of exposure. The author has determined the initial drift of two types of cells, a copper oxide and selenium, for a number of different circuit resistances. He also comments on ageing of the cells. S. S. B.

59. Measurement of Diffusion.
Sub-committee on Diffusion of Illuminating Materials. Am. Illum. Eng. Soc. Trans., 1, pp. 109-121, January, 1939.
An interim report is given on a method of measurement of diffusion involving the determination of the polar distribution of intensity and/or brightness given by the diffusing medium. The results obtained by nine laboratories on various materials are compared, with a view to determining the reproducibility of result and the best test procedure. J. S. S.

60. Light Reflection from Painted Surfaces.
J. A. Meacham. Am. Illum. Eng. Soc. Trans., 1, pp. 87-108, January, 1939.
A paint for interior use should hide irregularities in colour and shadow on the underlying surface, and should reflect as high a percentage of incident light as possible. The relation between these two functions, expressed as light transmission and light reflection factors, and the covering power of the paint, is investigated for several types of white oil paints. J. S. S.

III.—SOURCES OF LIGHT.

61. Important Improvements in Fused-Quartz Mercury Arcs.
L. B. Johnson and S. B. Webster. Rev. Sc. Insts., Vol. 9, p. 325, October, 1938.
Five new alternating current mercury arcs between oxide-coated tungsten electrodes in fused-quartz are described, and the spectral intensity of each lamp is tabulated. Several points of superiority over familiar mercury-pool cathode types are discussed. F. I. C. B.

62. New 100-watt Fluorescent Lamp for Industry.
Anon. Am. Illum. Eng. Soc. Trans., 1, p. 8, January, 1939.
A tubular low pressure mercury vapour fluorescent lamp 4 feet in length and dissipating 100-w., is announced. The efficiency is claimed to be 50 lumens per watt, but no information on the colour rendering obtained is given. J. S. S.

63. Electric Discharge Tubes.
C. C. Paterson. Elect., 122, pp. 105-106, January 27, 1939.
Fluorescent lamps, "black" lamps, sodium lamps, and a new air-cooled mercury vapour lamp, are included in a summary of progress in lamp development during 1938. C. A. M.

64. Low-Pressure Luminescent Tubes.
Anon. El. Rev., Vol. CXXIV., No. 3,197, p. 164, February 3, 1939.
Discusses results obtained relating to the transformation, by luminescent powders or glasses, of radiation emitted by low-pressure positive columns of mercury vapour discharges. R. G. H.

65. Characteristics of Fluorescent Lamps.
G. E. Inman. Am. Illum. Eng. Soc. Trans., 1, pp. 65-86, January, 1939.
A general description of 15, 20, and 30-w. low-pressure tubular luminiscent discharge lamps is given. The operation, spectral distribution, and temperature characteristics of the various types available is discussed. J. S. S.

66. Fluorescent Lamps for Homes.
Mary Webber. Magazine of Light, VIII., No. 1, pp. 29-31, February, 1939.
Suggestions are made on the use of fluorescent lamps in the house. C. A. M.

67. Effect of Temperature on Fluorescent Lamps.
J. W. Marden, N. C. Beese, and G. Meister. Am. Illum. Eng. Soc. Trans., 1, pp. 55-64, January, 1939.
It is stated that low-pressure fluorescent mercury vapour discharge lamps, of the type using a coating of zinc silicate, cadmium silicate, or calcium tungstate, give a maximum light output at about 45°c. The light output is found to vary with temperature in the same way as the activating ultra-violet energy of the discharge, and it is concluded the fluorescent material itself is unaffected by small changes in temperature. J. S. S.

68. New Phototherapy Lamps.
Anon. Elect., 122, p. 167, February 10, 1939.
A brief description, with two photographs, are given of a small phototherapy unit, employing a 100-200-w. lamp of special design of filament and bulbs. C. A. M.

69. A Simple Xenon Lamp for the Production of Short-wave Ultra-Violet.
M. von Ardenne. Zeits f. Techn. Physik, No. 1, pp. 30-31, January, 1939.
A description, with illustrations, is given of a Xenon lamp emitting radiation at 1295 A° and 1469 A°. W. R. S.

IV.—LIGHTING EQUIPMENT.

70. Aerodrome Equipment.
Anon. Elect., 122, p. 188, February 10, 1939.
A description is given of various types of aerodrome lighting equipment recently on exhibition in London. C. A. M.

71. Photographic Lighting Equipment.
Anon. Elect., 122, p. 152, February 3, 1939.
Full details, with photographs, are given of recently developed lighting equipment designed for use in cinema studios. C. A. M.

72. Stage Lighting Recommendations.
Anon. Magazine of Light, VIII., No. 1, p. 4, February, 1939.
A brief description of lighting equipment necessary for a small stage is given. Full details of the individual items, together with a plan of their disposition, are included. C. A. M.

73. The Dublin Lantern.
Anon. El. Times, 95, p. 46, January 12, 1939.
A description, with photographs, is given of a street-

lighting lantern designed for Dublin. Lanterns carrying 1,000-w. lamps are mounted at 25 feet, and those with 1,500-w. lamps at 30 feet. Good lighting is said to be obtained on roads well above ordinary widths. W. R. S.

74. Water Gauge Illuminator.
Anon. El. World, III., p. 166, January 14, 1939.
A neon tube is used in a liquid level gauge, by which it is claimed that the liquid level can be observed at distances of 150 feet and more. The lens action of the liquid is utilised to give an indication, by forming a magnified image of the bright red tube, the height of which corresponds to the liquid level. An aluminium protecting case is supplied. S. S. B.

75. Relay Contacts—Their Ailments.
A. W. Clement. Electronics, II., No. 12, p. 29, December, 1938.
The characteristics of relay contacts are considered, and practical points, such as shape, pressure, cleaning, etc., are discussed. S. S. B.

76. Protective Films on Metals.
L. E. Price and G. J. Thomas. J. Inst. Metals, Vol. LVIII., No. 2, pp. 21-28 and 29-65.
By appropriate pre-treatment it is possible to form protective films of alumina on alloys of silver or copper containing 1 per cent. of aluminium. These films produce a remarkable resistance to oxidation and tarnishing over a wide range of temperatures. R. G. H.

V.—APPLICATIONS OF LIGHT.

77. Progress During 1938.
H. W. Richardson. G.E.C. Journal, X., pp. 4-7 and pp. 2-32, February, 1939.
A comprehensive survey is made of progress during 1938 in almost every field of illuminating engineering. Numerous photographs are given. C. A. M.

78. Progress in Illumination.
Anon. El. Journal, Vol. XXXVI., No. 1, p. 33, January, 1939.
An illustrated review of the more notable advances in American illumination and lamp technique during 1938. R. G. H.

79. Plus Light for Seeing.
H. R. McIntyre. Magazine of Light, VIII., No. 1, pp. 20-22, February, 1939.
Silvered bowl lamps of 500-w. and 750-w. rating are used extensively in the lighting equipment of a new school in Texas. C. A. M.

80. Artificial Lighting.
G. V. Downer. El. Rev., Vol. CXXIV., No. 3,193, p. 159, February 3, 1939.
The reasons for advocating glareless indirect lighting are examined, and the theory is put forward that in a well-designed artificial interior lighting installation high intensities (about 5 foot-candles) are unnecessary and probably injurious to eyesight. R. G. H.

81. Light and Architecture.
Anon. Am. Illum. Eng. Soc. Trans., 1, pp. 10-20, January, 1939.
Some typical architectural lighting schemes are described with photographs. J. S. S.

82. The Quantitative Relationship Between Visibility and Type Size.
Matthew Luckiesh and Frank K. Moss. Frank. Inst., J., 227, p. 87, January, 1939.
The authors discuss suitable scales for measuring visibility of objects, and derive one with the merit that it takes into account the actual visual effectiveness of the factor of size in seeing. Curves are given relating Bodoni type size with visibility on such a scale. From these data a direct comparison can be made of the visibility of different type sizes; or the percentage visibility of adequate type size for a given purpose which is provided by any other size of type can be determined. S. S. B.

83. Luminous Tube Interior Lighting.
H. A. Miller. El. Rev., Vol. CXXIV., No. 3,192, p. 123, January 27, 1939.
Discusses the planning of interior lighting installations with cold cathode discharge tubes. Practical installation details are given. R. G. H.

84. Garage Lighting Serves Double Purpose.
H. G. Clum. El. World, 110, p. 1,835, December 31, 1938.
Some details are given of an installation, in which both tungsten filament and mercury vapour lamps are used in a garage and service shop of an electric power company. S. S. B.

85. Counter Lighting.
W. M. Potter. Magazine of Light, VIII., No. 1, p. 15, February, 1939.
An unusual feature in counter lighting in a railway ticket office in Denver is the use of aluminium parabolic reflectors recessed deeply into a saffit. A diagram is given. C. A. M.

86. Lighting for the Machining of Small Metal Parts.
Committee on Industrial and School Lighting. Am. Illum. Eng. Soc. Trans., 1, pp. 22-54, January, 1939.
Experiments on the lighting of steel rules, machine tools, etc., are described. In general, a light source of low brightness, subtending a large angle at the point of work, is desirable. Detailed recommendations for the illumination of micrometer gauges, bench work, and various machine tools are given. J. S. S.

87. Better Lighting Aids Wire Mesh Production.
J. B. Williams. El. World, 111, p. 148, January 14, 1939.
Exceptionally good lighting is required in the manufacture of fine-mesh wire belting (used in the manufacture of paper). A system combining mercury vapour and tungsten filament lamps has been found to give excellent results, and details of the installation are given. S. S. B.

88. Phototube Scans Steel for Pin-hole Flaws.
Anon. Electronics, 11, No. 12, p. 42, December, 1938.
A brief description is given of scheme for detecting pinhole flaws in steel strip. An intense beam of light scans the 36-inch-wide strip, and a photo-electric cell responds to any light passing through flaws in the metal. Speeds up to 900 feet per minute for the strip are possible. S. S. B.

89. Lakewood Theatre, Dallas.
F. M. Falge. Magazine of Light, VIII., No. 1, pp. 12-13, February, 1939.
Details, with photographs, are given of novel lighting features in the lighting equipment of the Lakewood Theatre, Dallas. Fluorescent lamps are used extensively. C. A. M.

90. Modern Street Lighting.
E. C. Lennox. El. Rev., Vol. CXXIV., Vol. 3,191, p. 89-90, January 20, 1939.
A report of a paper read to the Electrical Power Engineers' Association. A comparison between annual costs of discharge and filament lighting systems showed distinct advantages for the former. A summary of the discussion on the paper is also given. R. G. H.

91. Street Lighting.
E. C. Lennox. Elect., 122, p. 62, January 20, 1938.
A summary is given of a paper by the author to the Electrical Power Engineers' Association. Particular attention has been given to the economics of various light sources. C. A. M.

92. Artistic Town Lighting.
Anon. Elect., 122, p. 168, February 10, 1939.
A brief description, with photographs, is given of the floodlighting of the old-type buildings of the Herzog Friedrichstrasse, Innsbruck. C. A. M.

93. Lighthouses in Eire.
Anon. Elect., 122, p. 76, January 20, 1939.
Some data are given of the changes in candle-power from two lighthouses in Eire. C. A. M.

94. Golden Gate Exposition.
Anon. Elect., 122, pp. 59-60, January 20, 1939.
Details are given of the elaborate lighting schemes installed in the 1939 Golden Gate Exposition. Fluorescent and ultra-violet lamps are used extensively. C. A. M.

95. Seeing—Photography and Colour Projection.
L. E. C. H. Elect., 122, pp. 69-70, January 20, 1939; pp. 122-123, January 27, 1939; pp. 147-148, February 3, 1939; pp. 179-180, February 10, 1939.
A series of articles is given on photography and colour projection. C. A. M.

Recent Patents

(Abstracts of recent Patents on Illumination & Photometry.)

No. 496,304. "Improvements in Incandescent Vapour Lamps."

Evans, W. E. (*Communicated by Standard-Light Gesellschaft Mit Beschrankter Haftung.*) *Dated July* 13, 1937.

In a suspended vapour lamp with an inverted incandescent mantle and an upright vaporiser, the vaporiser is vertically pendent, the fuel pipe leads from the container in an upper part of the lamp to the bottom of the vaporiser and the operating mechanism for the cleaning needle of the burner nozzle is arranged at the bottom end of the vaporiser and is controlled by a hand lever extending through the reflector. A pre-heating tray or supporting trough is located near the burner nozzle. The fuel reservoir is annular above the reflector and surrounds the flue.

No. 496,979. "Improvements in Lighting Fittings."

Holophane, Ltd., and English, S. Dated November 10, 1937; *January* 9, 1937. (*Cognate Applications.*)

This specification covers a street lighting or similar fitting for directing light into a preferred plane in which a prismatic reflector positioned in proximity to the light source has prisms with their lengths parallel to the light source, certain of the prisms refracting the light rays into a beam above the horizontal and others refracting the light rays downwards. A reflector is positioned above the light source and is adapted to receive and reflect downwards the upwardly refracted light from the source.

No. 497,457. "Improvements in and Relating to Electric Discharge Devices."

The British Thomson-Houston Company, Limited. Dated September 18, 1936. (*Convention, Germany.*)

A light sensitive relay apparatus, according to this specification, comprises an electronic valve having a cathode and a control electrode adapted to receive primary electrons emitted from the cathode and to emit secondary electrons. The control electrode is so located with respect to an anode that electrons emitted by the control electrode are received by the anode. The control electrode is connected to the cathode through a high resistance and a source of potential and is activated with photo-electric emissive material so that the emission therefrom is influenced by illumination. The potential applied to the control electrode is adjusted so that the operation is stable at some pre-determined illumination, but on increase of illumination the condition becomes unstable and a large increase of secondary emission and anode current follows.

No. 497,587. "Improvements in Electric Incandescent Lamps."

Röver, W. Dated June 18, 1936. (*Convention, Germany.*)

This specification covers an incandescent lamp for emergency, such as A.R.P. purposes, having a bulb which is coated, except for a small clear window, with opaque lacquer, and the filament is of the smallest practicable diameter, e.g., 0.011 mm. and of such a length that its temperature is not greater than 1,500° C. In this way excessive temperature of the lamp is prevented.

No. 497,811. "Improvements in Electric Discharge Lamps."

The General Electric Company, Ltd. (*Communicated by Patent Treuhand Gesellschaft für Elektrische Glühlampen m.b.H.*) *Dated September* 27, 1937, *September* 28, 1937. (*Cognate applications.*)

This specification covers a discharge lamp of the cold electrode type of which the filling is mainly neon at a partial pressure of between four and eight millimetres having krypton and/or xenon added to an extent of 0.2 per cent. to 0.9 per cent. of the neon. Some mercury vapour may be added, and the electrodes are preferably hollow cylinders. For some reason unexplained the current voltage characteristic of such a lamp is positive over an appreciable range of currents.

No. 497,821. "Improvements in and Relating to Electric Discharge Lamp Systems."

The British Thomson-Houston Company, Limited. Dated March 27, 1937. (*Convention, U.S.A.*)

This specification describes an arrangement of discharge lamp flashing at mains frequency in which a rectifier is connected in series with the lamp and the rectifier or the resistance shunting it has such a value that, during the half cycle at which the rectifier would normally prevent the flow of current through the lamp, the voltage it supplies to the lamp is sufficient only to maintain ionization.

No. 497,822. "Improvements in Electric Gas or Vapour Discharge Tubes."

N. V. Philips Gloeilampenfabrieken. Dated May 14, 1937. (*Convention, Germany.*)

This specification describes a gas-filled discharge tube surrounded by a closed envelope containing luminescent material and also by a screen transparent to rays produced. The screen forms a closed space which extends all round the discharge tube but is only partly surrounded by the space formed between the screen and the envelope. The space between the discharge tube and the screen is filled with gas or vapour in which convection currents take place to dissipate heat from the part of the screen which is not enclosed by the envelope.

No. 497,880. "Electric Incandescent Lamp."

Vereinigte Glühlampen Und Elektrizitats Aktiengesellschaft. Dated December 8, 1936. (*Convention, Germany.*)

In order to improve the efficiency of incandescent lamps, according to this specification, an optical arrangement is contained within or forms part of the lamp bulb such that it reflects back, more with increasing wavelength, radiation to the incandescent body. This optical arrangement disperses the light and reflects back to the incandescent body undeflected and undispersed radiation of longer wavelength. The dispersing medium may be opal glass and the reflecting arrangement may consist of prisms or pyramids which totally reflect the longer wavelengths.

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Public Lighting With Gas

A recent important street lighting contract in the London area is a fifteen-year agreement made between the Borough of Acton and the Gas Light and Coke Company. About 2,034 lamps are covered by the contract, which specifies various improvements in illumination.

The Borough of Wanstead and Woodford have agreed upon gas lighting under a five-year contract for a portion of the Southend arterial road which comes within their area. The lighting, by 12-mantle gas lamps fitted with directional reflective devices, is in accord with the M.O.T. standard. This and the preceding agreement are two out of thirteen contracts for gas lighting entered into during the past twelve months by authorities in the area served by the Gas Light and Coke Company. Some of these are for periods of ten years.

The Chigwell U.D.C. entered into a ten-year agreement in 1934 for gas lighting in their area. In view, however, of the improvements in the lighting considered necessary last year, comprising the substitution of lamps of a greater candle-power for some 560 lamps and the installation of various new lamps, leading to an increase in the light output of 50 per cent., the contract has been extended to 1949.

The use of gas for street lighting has been decided on by the Parish Councils of St. Peter Port, St. Sampson, Vale, and St. Andrew, Guernsey, in renewing their lighting agreements for the coming year. The States of Guernsey have also renewed the gas lighting contract covering the harbours, etc.

Kirbymoorside (Yorks) Parish Council has entered into a five-year contract for gas lighting in the streets under its control.

Buckfastleigh Urban District Council has chosen gas as the medium of public lighting in Buckfast and Buckfastleigh for the next seven years.

The Burgh of Galton (Ayrshire) has entered into a ten-year agreement for public lighting by gas after seeing a demonstration of modern lamps. The lighting of the town has already been greatly improved, and further improvements are contemplated. A number of other local authorities have inspected the new lighting to learn how best they can increase their own lighting.

A five-year contract in which gas is the illuminant to be used has been made in respect of Moretonhampstead, Devon.

South Brent is another Devon parish lighted by gas under a recent contract for a number of years. Here, the term of the agreement entered into by the Parish Council is three years.

Long-term contracts for gas lighting in force in Devonshire rural areas cover the town and villages of Charmouth (a five-year agreement), Kingsbridge and West Alvington (four years), Cullompton (three years), Bradninch (three years), and Ashburton (ten years).

A five-year contract has been entered into by the Nantyglo and Blaina U.D.C. specifying gas lighting in their area. About 340 lamps are at present in commission.

Of the 101 miles of public lighting in Rotherham, ninety-six miles are lighted by gas and five by electricity, with 2,238 gas and 180 electric lamps respectively.

The Huntington (Staffs) Parish Council has entered into a three-year contract for gas lighting in the streets under its control.

Steady progress in raising the candle-power of lamps and in the installation of additional lighting units is being carried out by the Royal Burgh of Rothesay Gas Department.

A three-year agreement for gas lighting has been entered into by the Clifton Parish Council.

Under a recent five-year contract made by the Rayleigh U.D.C., a number of modern gas lamps have replaced existing lamps of a lower candle-power in the main street of the village.

Experiment to Illustrate the Visual Perception of Contrast at Different Adaptation Levels

by

R. G. HOPKINSON, B.Sc. (Eng.), F.R.P.S.

The contrast and density to which a photograph should be printed in order to give a faithful impression of the original has been shown by Renwick and others to depend upon those properties of the human eye which determine the ability to perceive variations of light and shade. It was shown by the author* that for faithful reproduction the contrast of a photograph should be unity, and that the density must be accurately determined by the relationship between the adaptation level of the eye under the taking and the viewing conditions. This was determined experimentally, and explained from a theoretical consideration of the physiological properties of the eye. The author drew attention to the fact that the range of tones (or, more strictly, of brightness) which the eye could perceive at any one moment was much less under conditions of extremely brilliant lighting than under conditions of dull lighting, but stated that there was evidence† that the visual mechanism which determines the apparent contrast of a scene does not alter to the same extent. There appears to be no simple and direct connection between the brightness range of the eye and its appreciation of contrast. This, of course, would be expected from the experimentally determined fact that a contrast of unity gives a faithful record of a scene, under a wide range of taking and viewing conditions.

More recently further evidence in support of this point has been obtained, and it can be demonstrated by a simple experiment that the appreciation of contrast does not change to a degree comparable with the change in the perceptible range of brightness.

A large condenser lens of about 12 in. diameter is uniformly flashed by light from a projector lamp, and is viewed from a distance of about 18 inches. The flashed condenser constitutes the adapting field of the eye. Immediately in front of the condenser lens is placed a small optical step-wedge, with a density range of 0 to 3, that is, a brightness range of 1,000 to 1, divided into twenty steps of equal density difference. This wedge is, of course, illuminated by light passing through the condenser lens to the eye. The brightness of the flashed condenser can be varied from 3 e.f.c. to 100,000 e.f.c., which latter value is well above the upper limit of brightness which the eye can perceive.

The observer views the flashed condenser and the wedge, first at a low level of brightness. The brightness of the condenser is then raised, the effect of which is to raise the adaptation level, and the steps of the wedge have brightnesses covering the range of the eye at a given moment.

If there were a direct and simple relation between the range of brightness which the eye can perceive at a given adaptation level and the appreciation of contrast, it would be expected that as higher and higher adapting brightnesses were reached, and hence as the range of the eye was decreasing rapidly, fewer and fewer of the wedge steps would be visible, but that the apparent contrast between them would increase very considerably. This is not so, however. The apparent contrast between the wedge steps alters hardly at all as the brightness of the condenser is raised. At very high brightnesses it is found that fewer and fewer steps of the wedge are visible, but that the apparent contrast between the steps remains approximately the same. As the absolute upper limit is approached only two steps are seen, one appearing black and one white, although the sensations given by the two steps are much more vague than those associated with the terms " black " and " white " under normal conditions. Finally, these two steps disappear when the brightness is raised to the upper limit such that the dazzle can no longer be tolerated, and all sensation of brightness difference is lost.

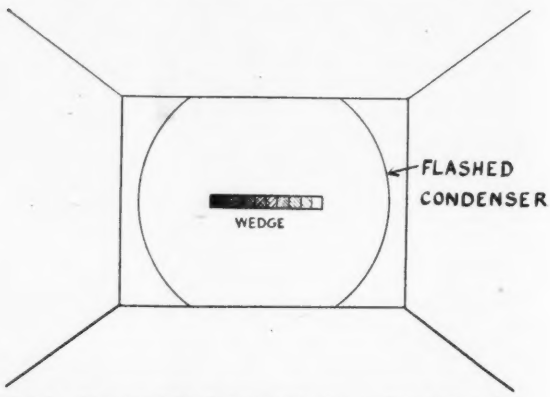

Fig. 1. Showing field of view, with step wedge surrounded by condenser lens flashed to a known degree of brightness.

It is obvious that an experiment such as this is capable of demonstrating differences of the first order only, but there seems every reason to believe that if there were a direct connection between the brightness range of the eye and the appreciation of contrast, it would be unmistakably shown by this experiment. As it is, the experiment shows that, so far as the first order of differences is concerned, the appreciation of contrast of the eye is independent of the brightness range, which confirms the evidence previously quoted. It also offers additional support for the theory that a faithful reproduction of a scene can be produced by a photograph of unity contrast, even though the adaptation levels under taking and viewing conditions may differ considerably.

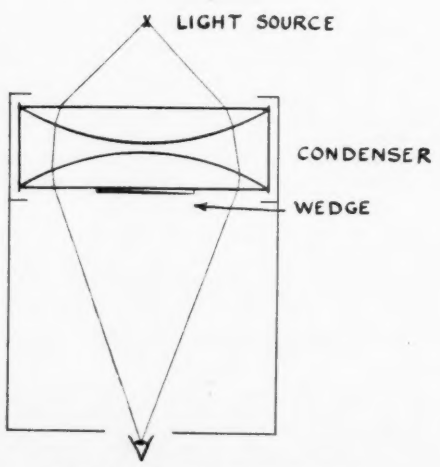

Fig. 2. Arrangement of apparatus.

*See Phot. J. 77, 542.

†M. Abribat. Compte Rendu de la Réunion de l'Institut d'Optique. April, 1935.

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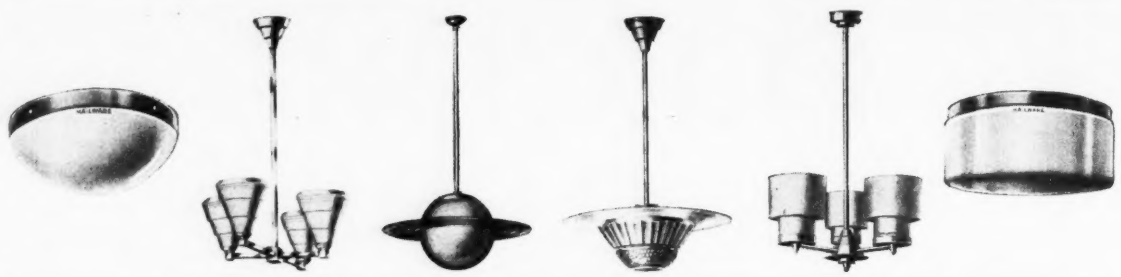

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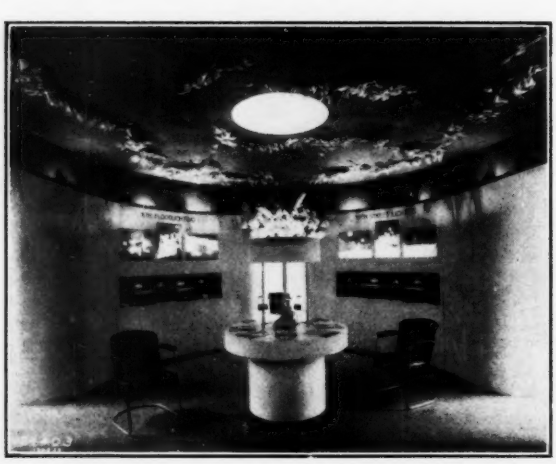
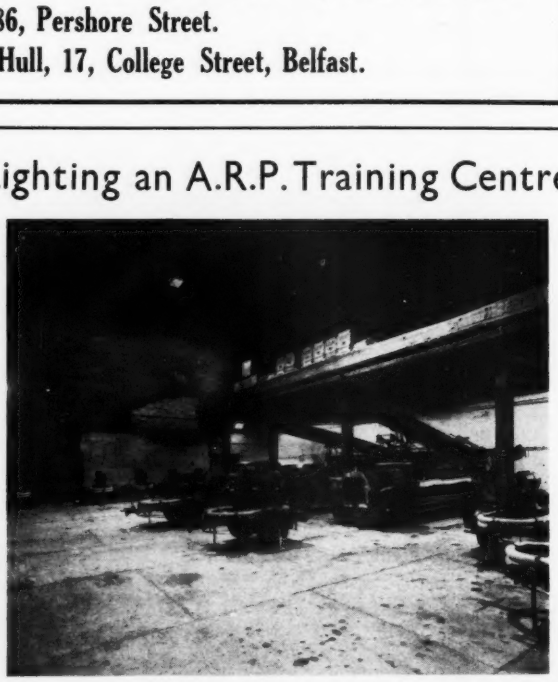


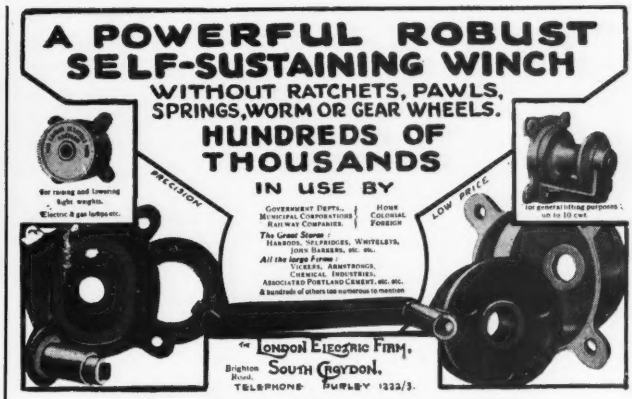
A novel effect at the stand of the British Thomson-Houston Company, Ltd., at the British Industries Fair was the ingenious fluorescent lighting effect illustrated above. The interior of the stand, forming an office and meeting place for visitors, had a black ceiling on which sprays of artificial flowers coated with fluorescent material were mounted. A bunch of similar flowers formed a decorative centre piece on the central table. All were excited by the invisible rays from concealed Mercra ultra violet lamps. On the office walls were photographic transparencies of typical lighting installations, with recesses in which control gear and accessories for lighting equipment were mounted.

Lighting an A.R.P. Training Centre



The picture above illustrates the lighting of the City of Nottingham Auxiliary Fire Station—one of the well-equipped A.R.P. training centres now in operation in that city. Much of the instruction, such as the handling of hoses, escapes, pumps, etc., has to be given out-of-doors during the evenings. Good lighting, both indoors and out, is, therefore, necessary. The installation consists of eleven 140-watt and six 85-watt Philips "Philora" sodium lamps. An interesting feature of this installation is that the control gear, although housed in separate cast-iron boxes for each lamp, is mounted on one main panel, instead of being fixed adjacent to each lamp, as is usually the case. The distance from the control panel to the most distant lamp is approximately seventy yards.

The lighting of Unter den Linden, the famous thoroughfare in Berlin.



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NOTES ON ILLUMINATING ENGINEERING ABROAD

(Specially Contributed—H. L. J.)

Germany.

In a contribution to "Das Licht" E.v.d. Trappen, discussing the reconciliation of architectural effect with technical requirements, is disposed to favour central suspension of lighting units in streets not more than 44 yds. wide. When trees border the actual carriageway means of suspension are largely hidden. In shopping centres the band of light in the centre of the road is well supplemented by light from shop windows, etc., so that a satisfactory illumination is achieved, particularly under wet conditions. Only in the case of highly representative roads are other solutions compulsory. The East-West arterial road in Berlin is given as an example of such a road. This starts with the Unter den Linden, an illustration of which is given above.

The Unter den Linden has a dual carriageway, approx. total width 60 yds.—two traffic lanes, each approx. 20 yds. wide, with approx. another 20 yds. for the centre paving. The installation illustrated was erected in 1935, and consists of four rows of standards. In those bordering the traffic lanes the height of the light point is 5 yds. Each standard bears one box-type housing, with flashed opal glass panels, and equipped with a 300-watt and a 200-watt lamp. The two combined are alight until midnight, after which the 300-watt lamp operates alone. Spacing is approx. 17½ yds., average illumination on surface of traffic lanes approx. 0.7 ft.c., uniformity 1 : 4. This installation stretches from the Castle to the Brandenburger Tor.

The street continues west almost straight for approx. another four and a half miles, and is in a stage of conversion to a dual traffic highway, each traffic lane approx. 20 yds. wide, but the centre paving dividing the two only 10 yds. wide. About half this stretch of road leads through the Tiergarten (Berlin's Hyde Park), and the remainder through built-up areas. As in the case of Unter den Linden, it has been decided to provide lighting from the borders of the traffic lanes, but no light on the centre paving. Owing to trees, a 20-yds. spacing has been adopted, each standard carrying two brackets bearing an upright lantern. Two types of lanterns have been developed, utilising four small and two large lamps. The beam from the latter is concentrated mainly on the carriageway, but in a direction conforming to that of the traffic flow, and also to help brighten up the adjacent footpath area.

In the second part of this road, passing through built-up areas, practically all light is thrown on the carriageway. This second type of lantern is panelled with refractor glass on the side facing the road and with flashed opal glass on the back. The height of lantern centre above ground level is approx. 6½ yds., the height of lantern approx. 1½ yds., and the wattage per lantern 1,500. 703 standards are allotted for the total length of road, and the minimum illumination produced on the carriageway approx. is 3.5 ft.c. Tungsten filament lamps are used throughout.

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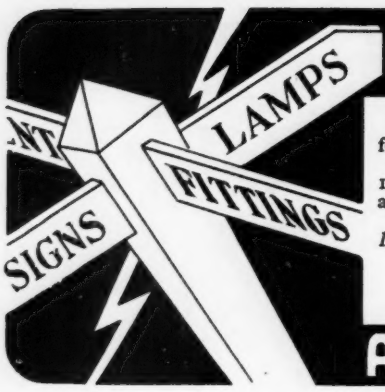

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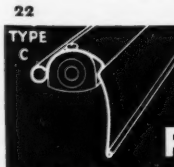

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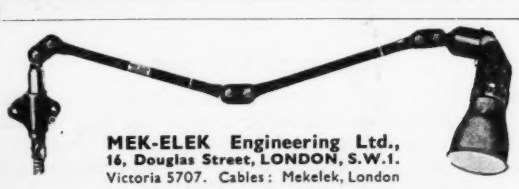

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The Lewisham Borough Council invite offers for the whole or part of some 3,000 gas controllers from public street lamps. Particulars and forms of tender can be obtained from the Borough Engineer, Town Hall, Catford, London, S.E.6.

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N.B.—The numbers are those attached to individual entries in the Directory (See pp. 68—70)

Holophane Stage Demonstration

On February 7 a novel display was given in the Holophane Theatre by the Corlett Players, in association with Holophane technical experts. Mr. R. G. Williams, chief colour engineer, compèred and lighted the demonstrations, and also gave a short address on the technique of colour lighting.

Amongst the more ingenious items was a photographic model of the "Chameleon" car shown at the Austin Stand at the Motor Show last October. Changes of light caused various parts of the car to disappear or come into prominence; by the same means a stage scene was changed from an English countryside to an Indian temple. A stage fantasy, "Princess Ilsa," written by Miss Renee Corlett, and based on a legend of the Brocken mountains, afforded a good opportunity for the use of light in connection with views of mountain scenery and cloud effects.

The Holophane moulded-contour system of interior decorative lighting was also on view, and excited a considerable amount of interest.

SITUATIONS VACANT

Electricity House, Ltd., require Lamp and Lighting Salesman, for developing Industrial Lighting in Yorkshire. Apply, stating experience, age, and salary required, to MMC/LS., 36, York-place, Leeds, 1.

Catalogues Received

CROMPTON PARKINSON, LTD.—Leaflet featuring new Crompton high-wattage filament lamps, with the new nickel steel stem, which is resilient, in place of the old rigid glass one.

EDISON SWAN ELECTRIC COMPANY, LTD.—A new catalogue dealing with "Industra" industrial lighting reflectors. About fifty types are specified. The catalogue also contains useful introductory data on the planning of lighting installations, for which a special "planning sheet" of squared paper is inserted.

MEK-ELEK ENGINEERING, LTD.—Catalogue giving full details of the Mekelite industrial lighting units, which are very adaptable and specially useful for local lighting.

SCANLAN'S NEW NEON, LTD.—Leaflet executed in colour showing the lighting with Cleora tubes of McIlwraith's, Ltd., a large store in Sydney, the first installation of the kind in Australia.

SIMPLEX ELECTRIC COMPANY, LTD.—New lists of lighting equipment, including industrial lighting units, floodlighting units, watertight fittings, etc., some of very recent design.

Contracts Closed

SIEMENS ELECTRIC LAMPS AND SUPPLIES, LTD.—*Malta Government Electricity and Water Dept.*: For some thousands of Siemens vacuum and gasfilled lamps during the year 1939. *Salford Corporation*: For twelve months' supply of Siemens electric traction lamps.